

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 2, 2019/2020

**PEM0026 – TRIGONOMETRY AND GEOMETRY**  
(Foundation in Engineering)

13 MARCH 2020  
3.00 p.m. – 5.00 p.m.  
(2 Hours)

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### INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages including the cover page and appendix.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary working **MUST** be shown.
4. Only **NON-PROGRAMMABLE** calculator is allowed.

## APPENDIX

### TRIGONOMETRY IDENTITIES

$$\sin^2 \theta + \cos^2 \theta = 1 ; \quad \sec^2 \theta = 1 + \tan^2 \theta ; \quad \csc^2 \theta = 1 + \cot^2 \theta$$

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2 \cos^2 \theta - 1 = 1 - 2 \sin^2 \theta$$

$$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$2 \sin A \cos B = \sin(A + B) + \sin(A - B)$$

$$2 \cos A \cos B = \cos(A + B) + \cos(A - B)$$

$$2 \sin A \sin B = \cos(A - B) - \cos(A + B)$$

$$\sin A + \sin B = 2 \sin \frac{A+B}{2} \cos \frac{A-B}{2} ; \quad \sin A - \sin B = 2 \cos \frac{A+B}{2} \sin \frac{A-B}{2}$$

$$\cos A + \cos B = 2 \cos \frac{A+B}{2} \cos \frac{A-B}{2} ; \quad \cos A - \cos B = -2 \sin \frac{A+B}{2} \sin \frac{A-B}{2}$$

$$\sin^2 \frac{A}{2} = \frac{1 - \cos A}{2} ; \quad \cos^2 \frac{A}{2} = \frac{1 + \cos A}{2} ; \quad \tan^2 \frac{A}{2} = \frac{1 - \cos A}{1 + \cos A}$$

$$\sin \frac{A}{2} = \pm \sqrt{\frac{1 - \cos A}{2}} ; \quad \cos \frac{A}{2} = \pm \sqrt{\frac{1 + \cos A}{2}} ; \quad \tan \frac{A}{2} = \pm \sqrt{\frac{1 - \cos A}{1 + \cos A}} = \frac{1 - \cos A}{\sin A} = \frac{\sin A}{1 + \cos A}$$

Continued...

**QUESTION 1 (25 MARKS)**

a) Find the exact value for  $\tan\left(\frac{10\pi}{3}\right)\csc\left(\frac{9\pi}{4}\right) - \sin\left(-\frac{11\pi}{6}\right)\cot\left(\frac{9\pi}{4}\right)$ . (6 marks)

b) Determine the amplitude, period and phase shift for  $y = -\frac{1}{2}\cos\left(3x + \frac{\pi}{2}\right)$ .

Then, sketch the graph for two period. Clearly show all the x-intercepts.

(9 marks)

c) Find all the angles of a triangle with lengths 9.5cm, 14.3cm and 20.7cm. Hence, find the area of the triangle. (10 marks)

**QUESTION 2 (25 MARKS)**

a) Establish the identity for  $\frac{\csc x}{\tan x + \cot x} = \cos x$ . (5 marks)

b) Without using calculator, find the exact value of  $\tan\left[\sin^{-1}\left(\frac{2}{7}\right)\right]$ . (5 marks)

c) Solve  $2\sec^2 x + \tan x = 3$  for  $0^\circ < x < 360^\circ$ . (6 marks)

d) Given  $\cos A = -\frac{3}{7}$ ,  $\pi < A < \frac{3\pi}{2}$  and  $\cos B = -\frac{3}{\sqrt{11}}$ ,  $\frac{\pi}{2} < B < \pi$ . Find the exact value of  $\cos 2B$  and  $\tan(A + B)$ . (9 marks)

**Continued...**

**QUESTION 3 (25 MARKS)**

- a) Find a rectangular equation for the curve represented by the polar equation

$$r = \frac{2}{3\cos\theta - 3\sin\theta}. \quad (3 \text{ marks})$$

- b) If  $x = 2(\cos 34^\circ + i \sin 34^\circ)$ ,  $y = 7(\cos 63^\circ + i \sin 63^\circ)$  and  $z = i + 3i$ . Find:

- i.  $z$  in polar form. (3 marks)

- ii.  $\frac{x}{yz^2}$  in rectangular form. (7 marks)

- c) Find a vector that is perpendicular to vector  $2\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$ . (3 marks)

- d) Given vectors  $\mathbf{a} = 4\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$  and  $\mathbf{b} = \mathbf{i} + \mathbf{j} - \mathbf{k}$ . Find

- i. the unit vector in the direction of the vector  $\mathbf{a}$ . (3 marks)

- ii.  $\mathbf{b} \times \mathbf{a}$ . (4 marks)

- iii.  $3\mathbf{b} - 2\mathbf{a}$ . (2 marks)

**QUESTION 4 (25 MARKS)**

- a) Write the equation of a circle whose diameter is the line segment joining  $A(2, 7)$  and  $B(-10, -3)$ . (6 marks)

- b) Sketch the graph of  $(y - 2)^2 = -12(x + 4)$  showing clearly the vertex, focus and directrix of the parabola. State the intercepts, if any. (10 marks)

- c) Graph the ellipse, locate the center and the foci of the equation:

$$\frac{(x+1)^2}{25} + \frac{(y-3)^2}{64} = 1. \quad (9 \text{ marks})$$

**End of Paper**